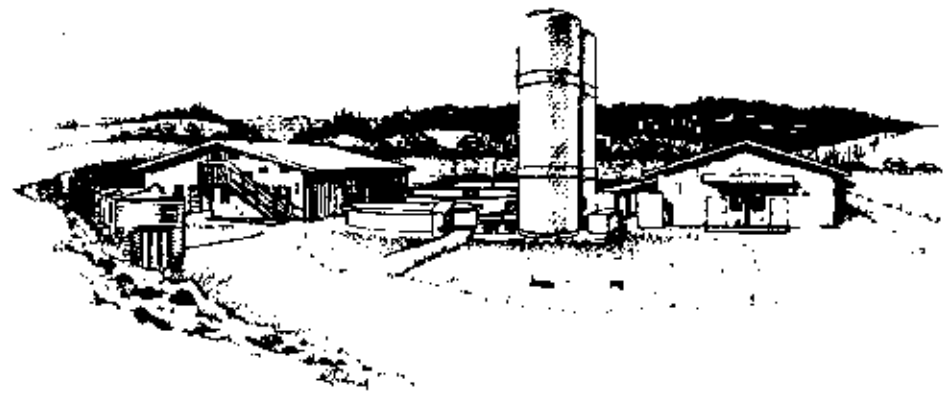
JOSEPH M. LONG
MARINE LABORATORY
100 Shaffer Road
Santa Cruz, CA 95060
Ph. (831) 459-2883
Fax (831) 459-3383



Ronald J. Schusterman, Ph.D.
Research Marine Biologist
Long Marine Laboratory
University of California, Santa Cruz
Santa Cruz, CA 95060
(831) 459-3345
rjschust@cats.ucsc.edu

Donna Wieting
Chief, Marine Mammal Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3226

Ms. Wieting,

The following is our comment on the FEIS completed by the U.S. Navy for the SURTASS LFA sonar system:

There is still relatively little data on hearing and the effects of noise on hearing for any of the marine mammals potentially at risk from this and other sound sources. My research laboratory has recently produced some of the relevant data on these issues. Some of these data are used in the FEIS to justify a safe one-time exposure (single ping) level of 180 dB re: 1μPa for all marine mammals. My research team and I wish to comment specifically on our previously published and recently collected data in the context of the SURTASS LFA FEIS. We also want to comment on the limitations of the over-simplified approach to risk assessment in this document. In our opinion, there are several critical points that need to be addressed regarding the risk assessment presented in the FEIS, particularly the selection of a single noise criterion for all marine mammals.

(1) The "pinniped" audiogram presented in Fig. 1-4 (p. 1-21 of the FEIS) is quite misleading. The use of this composite curve downplays the potential impacts of SURTASS LFA on pinnipeds and demonstrates an oversimplification and ignorance of published audiometric data. First of all, the substantial differences in absolute hearing capabilities, primarily with respect to frequency ranges of hearing, between phocid and otariid pinnipeds are well established. Indeed, one of us (RJS) discussed this distinction in a frequently referred to review article 20 years ago (Schusterman, 1981). Just as the theoretically derived mysticete and empirically derived odontocete audiometric data differ, so do the empirically derived phocid and otariid data. There is no scientific basis for combining all the

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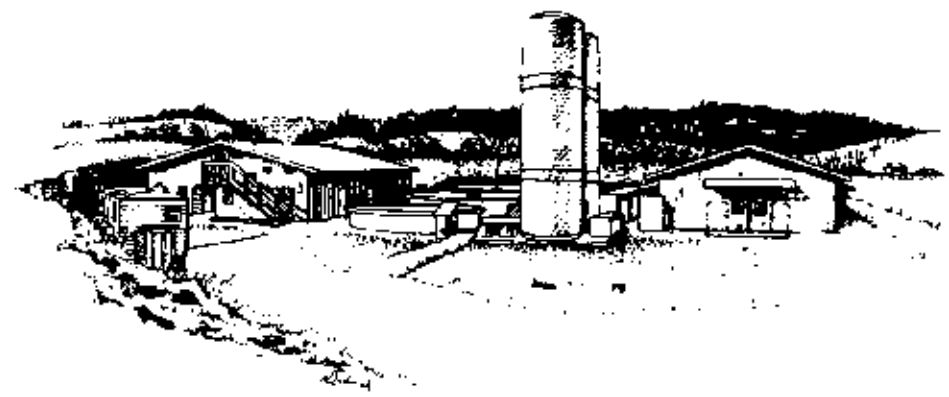

pinnipeds into one group. Second, the composite audiogram ignores published data on pinniped hearing at frequencies within the SURTASS LFA band (Kastak and Schusterman, 1998; 1999). If included, these data would dramatically alter the composite audiogram. While these important results were ignored, other somewhat problematic data were presumably included. We assume that the Hawaiian monk seal audiogram (Thomas et al., 1990) was incorporated into the composite audiogram because the reference in the FEIS is simply to Richardson et al. (1995). There are a number of problems with this study, which we have discussed personally with several of the authors, that bring into question the validity of including this apparently aberrant phocid audiogram in a "representative" pinniped audiogram. Compiling separate composite audiograms for the phocids and otariids, including the Kastak and Schusterman (1998; 1999) data and excluding the Thomas et al (1990) data, would paint quite a different picture of the potential degradative impacts of SURTASS LFA on pinnipeds. Specifically, the composite audiograms would be shifted down in absolute sensitivity at the frequencies associated with SURTASS LFA, indicating an increased likelihood of their being negatively impacted by its deployment. On the basis of published audiometric data alone, all of the phocid pinnipeds and most notably the northern elephant seal (see Kastak and Schusterman, 1999), should be given greater consideration in terms of likely harassment than is the case in the FEIS.

(2) The extrapolation of human hearing loss data to create models for estimating potential injury to marine mammals may be unfounded. Our most recent data (Schusterman et al., 2000) on the relative influences of noise duration and intensity on temporary threshold shift (TTS) in pinnipeds suggest that the equal-energy relationship derived from clinical studies on humans (see Ward, 1997) may not apply for TTS in some marine mammals. From the standpoint of noise duration and intensity, the equal energy hypothesis states that exposures of equal energy result in approximately equal fatiguing effects. Deviations for some species from this relationship likely mean that calculations of equivalent quiet (EQ) and EQ differential levels for noise exposures of extremely different temporal properties are invalid. Additionally, it is extremely unlikely that animals would be exposed to only one ping from SURTASS LFA, as they are mobile in a three dimensional environment and periodically surface to breathe. It is ironic that the FEIS repeatedly cites Ward (1997) to support extrapolations based on the equal energy hypothesis when indeed Ward (1997) concludes that the expected relationships between auditory fatigue and noise exposure/duration parameters break down for multiple exposures.

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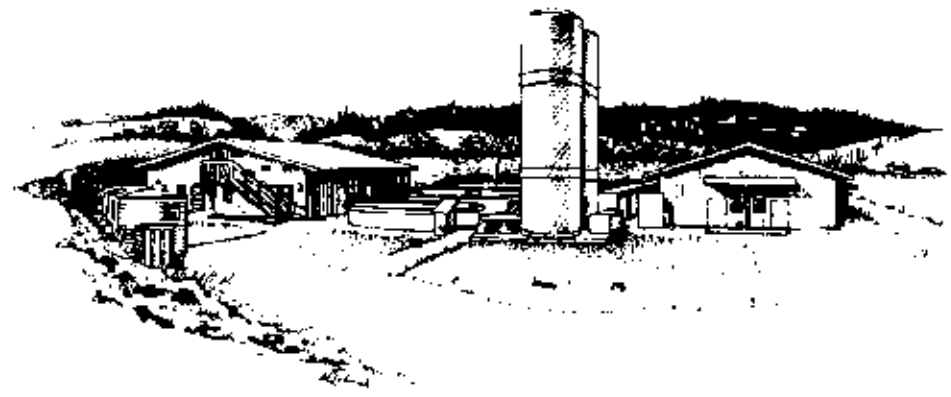

(3) The FEIS states several times that their calculations of auditory impacts are conservative estimates. However, the calculation of EQ levels for marine mammals are based on the 80 dB value determined for humans (presented in Table 1-2). This calculation ignores our (1996; 1999) data, discussed later in this section, which indicate that the onset of TTS for some pinnipeds at octave-band levels is on the order of 60-70 dB sensation level. Thus, the more conservative approach, and one based on empirical data for some of the marine mammal species at risk, would place equivalent quiet levels at least 10 dB lower than the 140 dB (re:1μPa) level given in Table 1-3.

(4) The assumption that the potential masking effects of SURTASS LFA are expected to be "negligible" because the bandwidth of sonar pulses is narrow and the duration of each signal is 10 seconds or less is incorrect. Many of the natural acoustic signals marine mammals likely use in communication, foraging, predator avoidance, and navigation are much shorter in duration than 10 sec. Provided that they occur within a similar frequency bandwidth as SURTASS LFA, which many of them clearly do, masking could occur hundreds of kilometers from the LFA source. Simply discounting masking because individual signals are brief seems to be an off-hand way of dismissing potentially damaging aspects of the system that would be experienced over a much greater area than the unacceptably small "LFA mitigation zone".

(5) Animals that are potentially disturbed or injured by exposure to noise, but are motivated to remain in an ensonified area experience an approach/avoidance conflict. This is one of the primary limitations to behavioral observations of noise impacts. Just because animals remain in a particular environment with an anthropogenic noise source present does not mean that they are not negatively impacted by it. They may be tolerating the interfering and/or fatiguing effects of the noise because it is occurring in an area of particular significance in terms of foraging, breeding, predator avoidance, or transit. Our recent laboratory studies on TTS demonstrated the approach/avoidance conflict in a captive setting (Kastak et al, 1999). Subjects demonstrated escape and avoidance responses to situations in which they anticipated being exposed to noise, but would eventually enter noise fields, probably because there was a spatial and temporal contiguity between the noise field and food.

In summary, we are very concerned that the assumptions underlying the extrapolation of clinical data on humans to predict noise impacts on marine mammals may be inappropriate in terms of actually predicting noise impacts for a wide range of species

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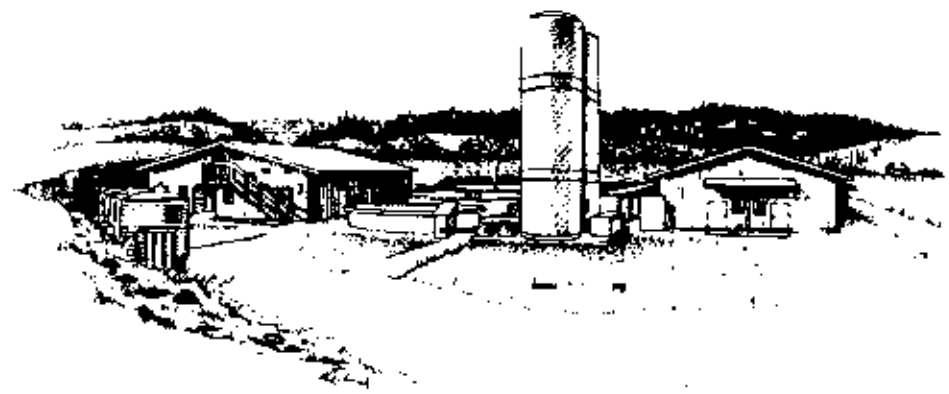

having varied hearing characteristics. The attempt to apply a single noise exposure standard for all marine mammals is a gross oversimplification of an exceedingly complex and poorly understood suite of issues. This kind of singular approach is, and will remain, myopic in considering the multiple issues regarding the effects of anthropogenic noise on marine mammals. Additional data on auditory fatigue resulting from noise with exposure parameters similar to specific sources and controlled comparisons of exposure duration/intensity tradeoffs are clearly needed for multiple marine mammal species. In conjunction with additional physiological and behavioral analyses, these data may provide a more comprehensive assessment of the potential degradative impacts of SURTASS LFA and other anthropogenic noise sources.

Sincerely,

Ronald J. Schusterman, Ph.D. (Laboratory Director of Pinniped Research in Cognition and Sensory Systems)
David Kastak, Ph.D.
Brandon L. Southall, M.Sc.
Colleen Reichmuth Kastak, M.Sc.

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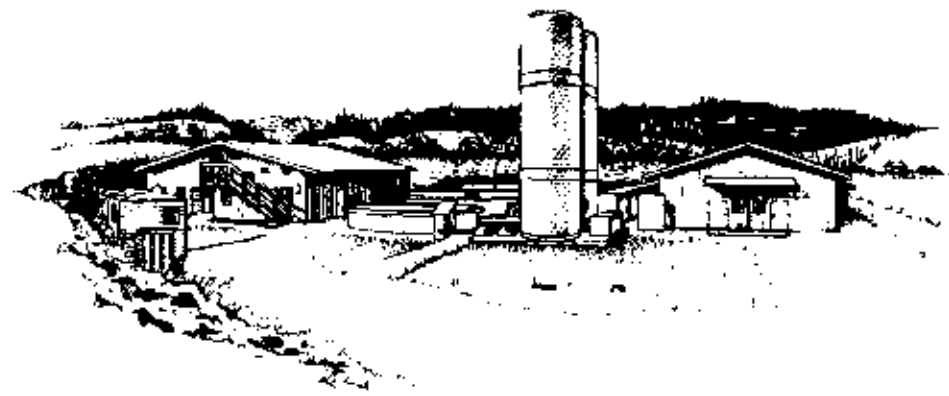

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